Fig. 1

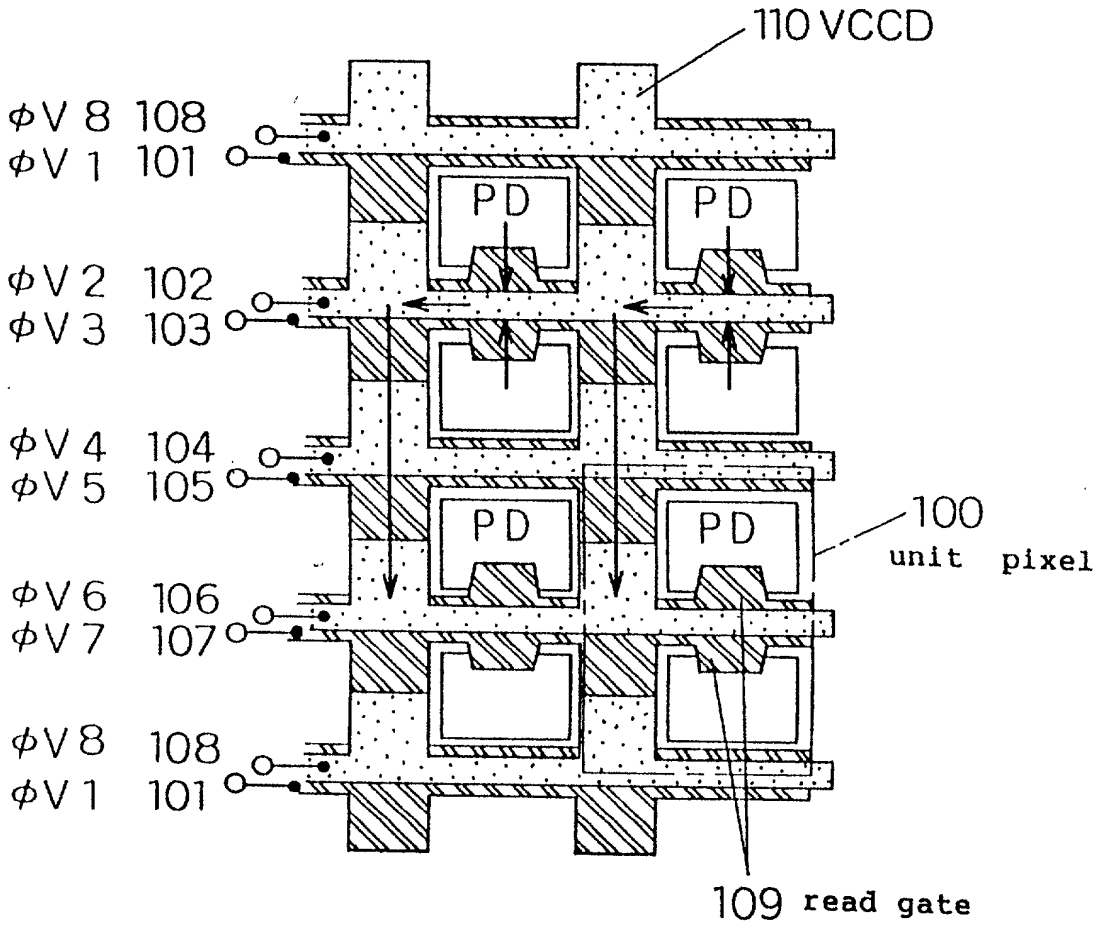

110 VCCD
φV 8 108
φV 1 101
φV 2 102
φV 3 103
φV 4 104
φV 5 105
φV 6 106
φV 7 107
φV 8 108
φV 1 101
PD
PD
PD
PD
100
unit pixel
109 read gate

Fig. 2

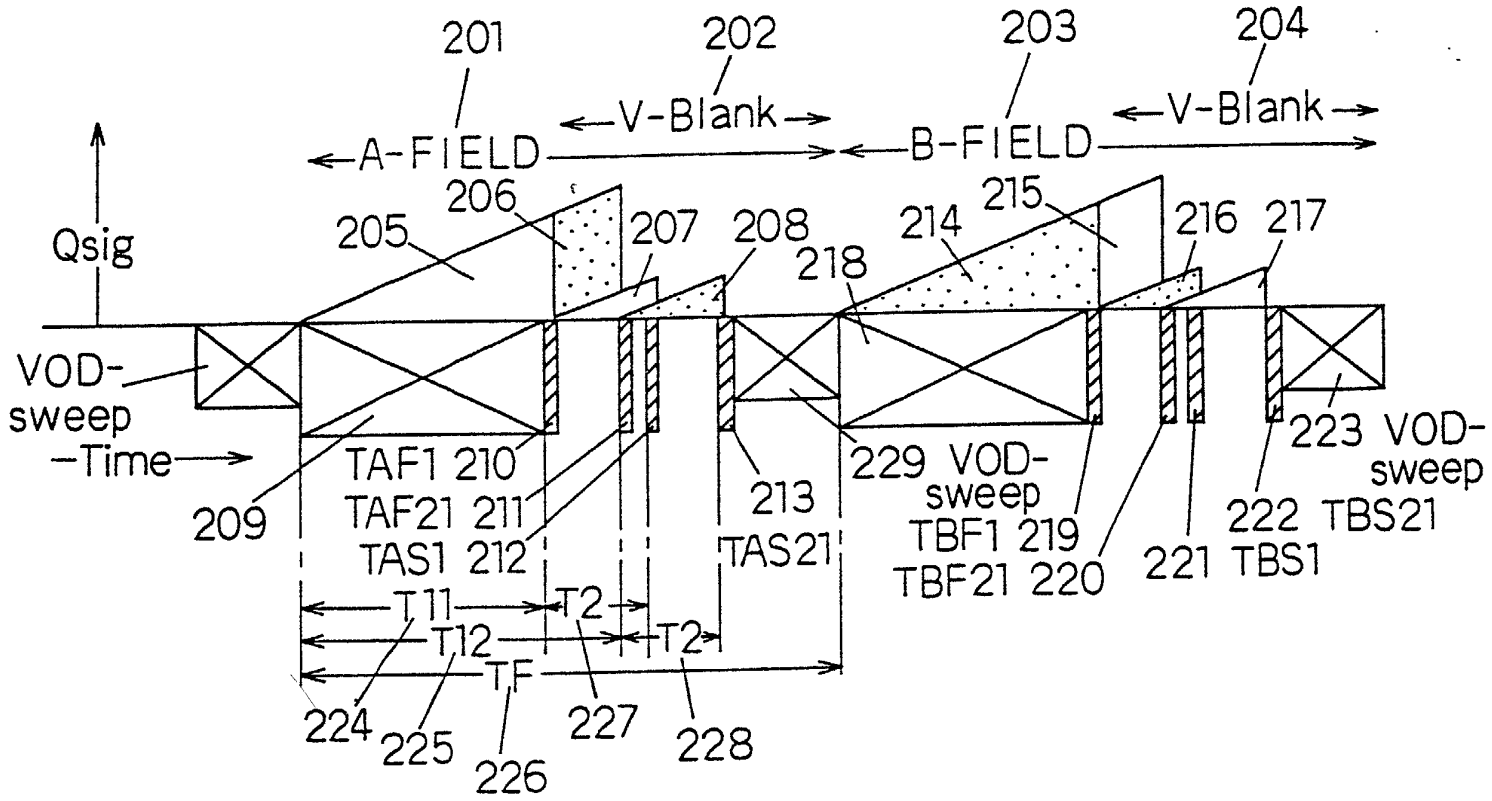

201
202
203
204
A-FIELD
V-Blank
B-FIELD
V-Blank
Qsig
205
206
207
208
214
215
216
217
218
VOD-
sweep
-Time
209
TAF1 210
TAF21 211
TAS1 212
213
TAS21
229 VOD-
sweep
TBF1 219
TBF21 220
221 TBS1
222 TBS21
223 VOD-
sweep
T11
T2
T12
T2
TF
224
225
226
227
228

Fig. 3

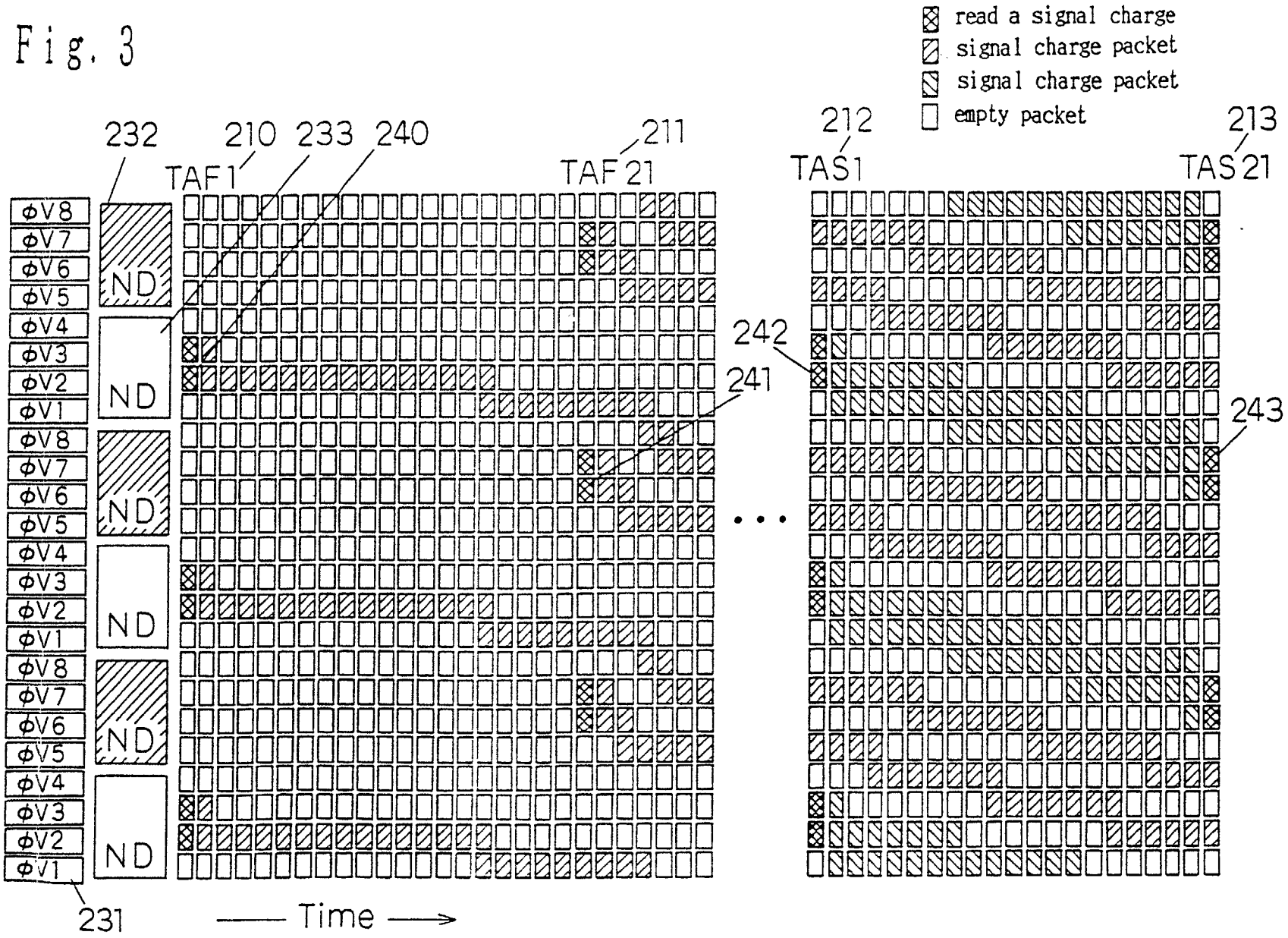

read a signal charge
signal charge packet
signal charge packet
empty packet
232
210
233
240
211
212
213
TAF1
TAF21
TAS1
TAS21
242
241
243
φV8
φV7
φV6
φV5
φV4
φV3
φV2
φV1
ND
231
Time

Fig. 4

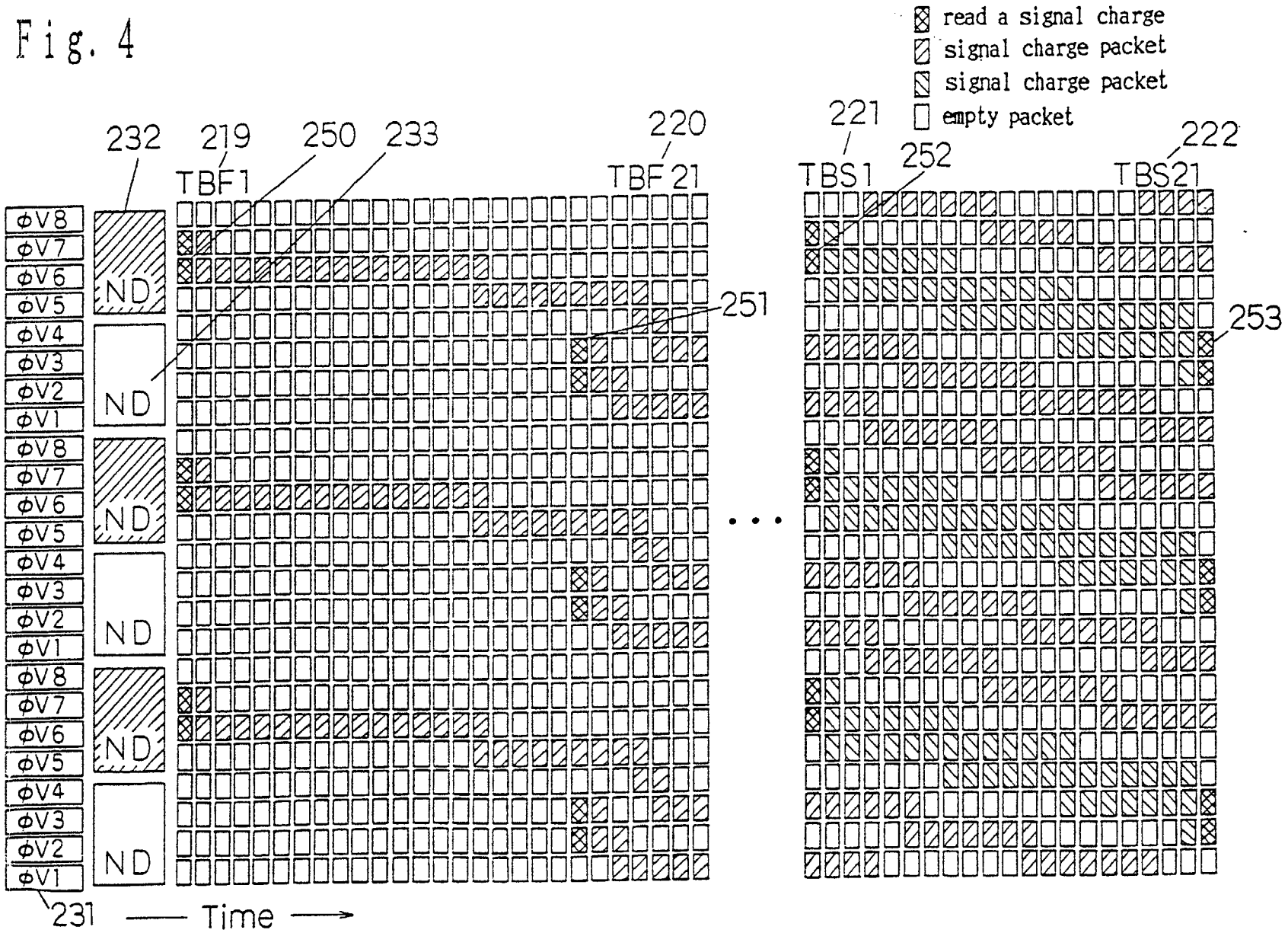

read a signal charge
signal charge packet
signal charge packet
empty packet
232
219
250
233
220
221
252
222
TBF1
TBF21
TBS1
TBS21
251
253
φV8
φV7
φV6
φV5
φV4
φV3
φV2
φV1
ND
231
Time

Fig. 5

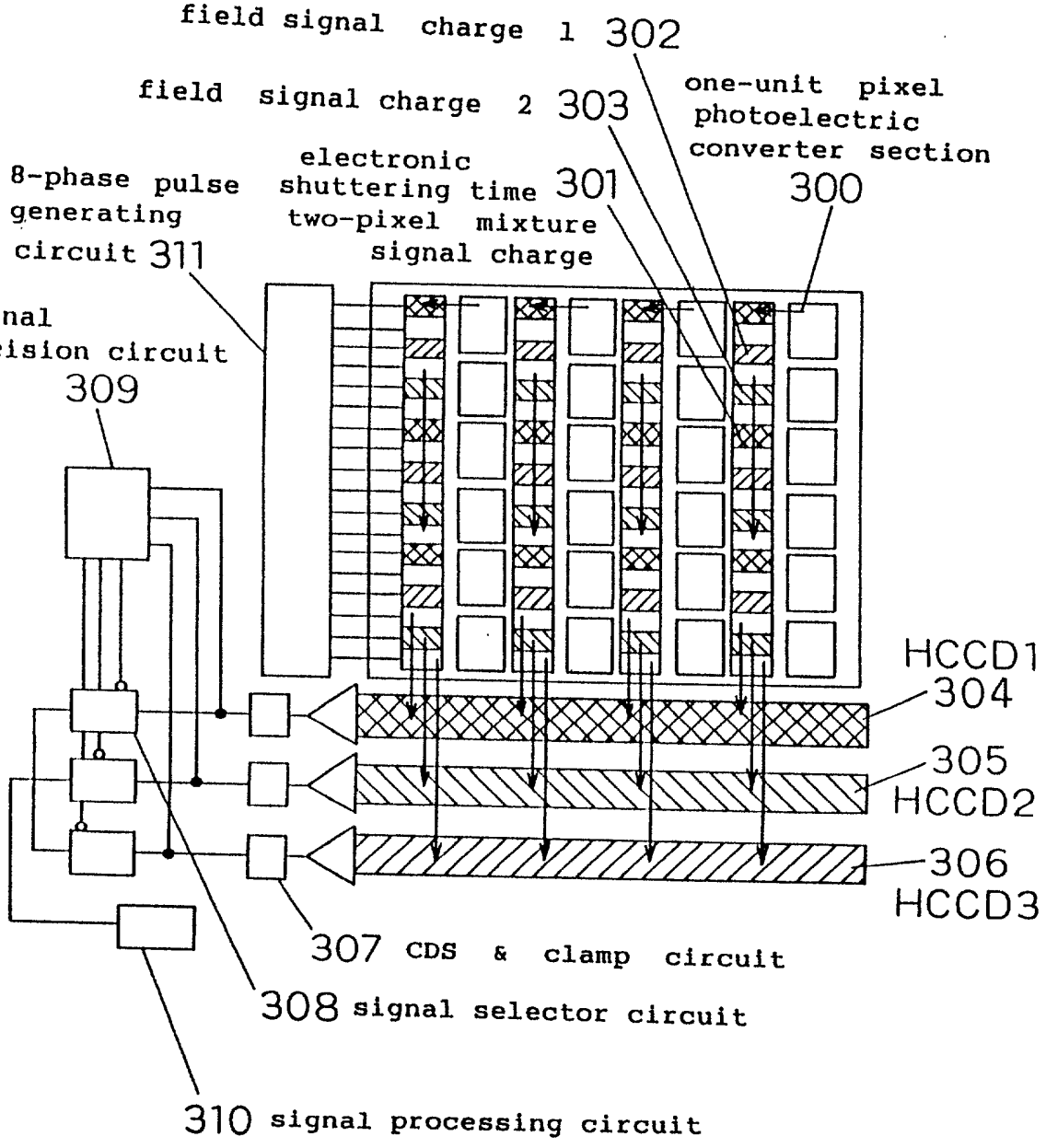

field signal charge 1 302
field signal charge 2 303
one-unit pixel photoelectric converter section 300
electronic shuttering time two-pixel mixture signal charge 301
8-phase pulse generating circuit 311
signal decision circuit 309
HCCD1 304
305 HCCD2
306 HCCD3
307 CDS & clamp circuit
308 signal selector circuit
310 signal processing circuit

Fig. 6

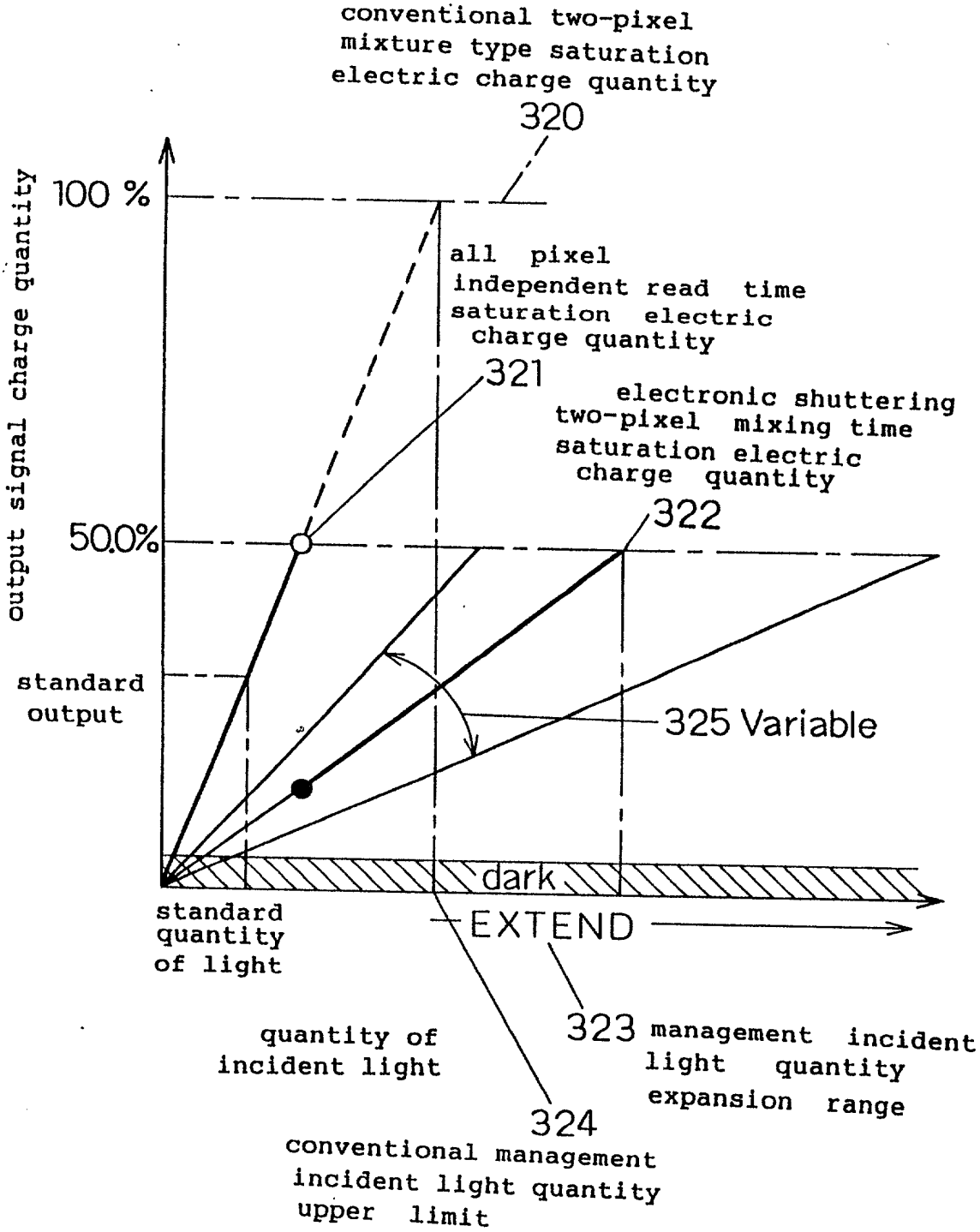

conventional two-pixel
mixture type saturation
electric charge quantity
320
100 %
output signal charge quantity
all pixel
independent read time
saturation electric
charge quantity
321
electronic shuttering
two-pixel mixing time
saturation electric
charge quantity
322
50.0%
standard
output
325 Variable
dark
standard
quantity
of light
EXTEND
quantity of
incident light
323 management incident
light quantity
expansion range
324
conventional management
incident light quantity
upper limit

Fig. 7

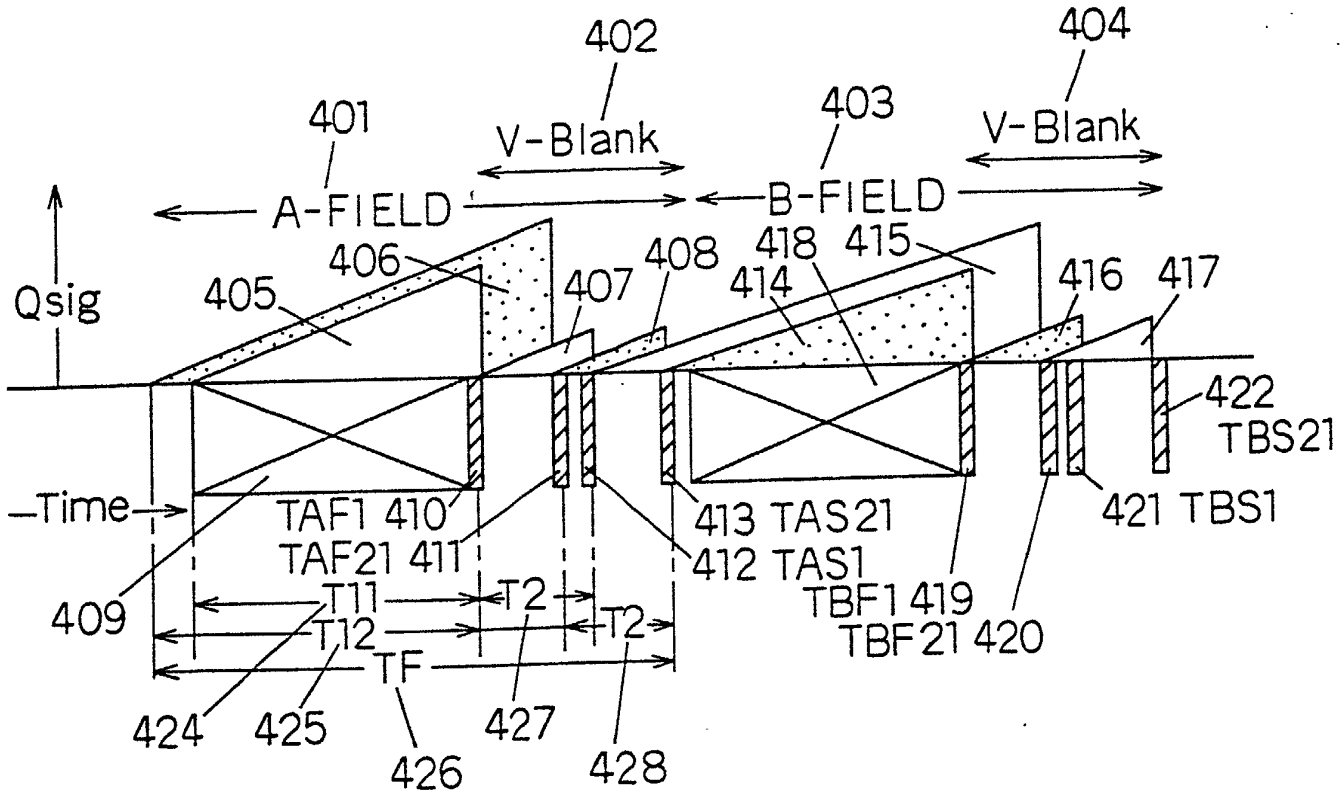

402
404
401
V-Blank
403
V-Blank
A-FIELD
B-FIELD
Qsig
406
405
407
408
418
415
414
416
417
422
TBS21
Time
TAF1 410
TAF21 411
413 TAS21
412 TAS1
421 TBS1
TBF1 419
TBF21 420
409
T11
T2
T12
T2
TF
424
425
426
427
428

Fig. 8

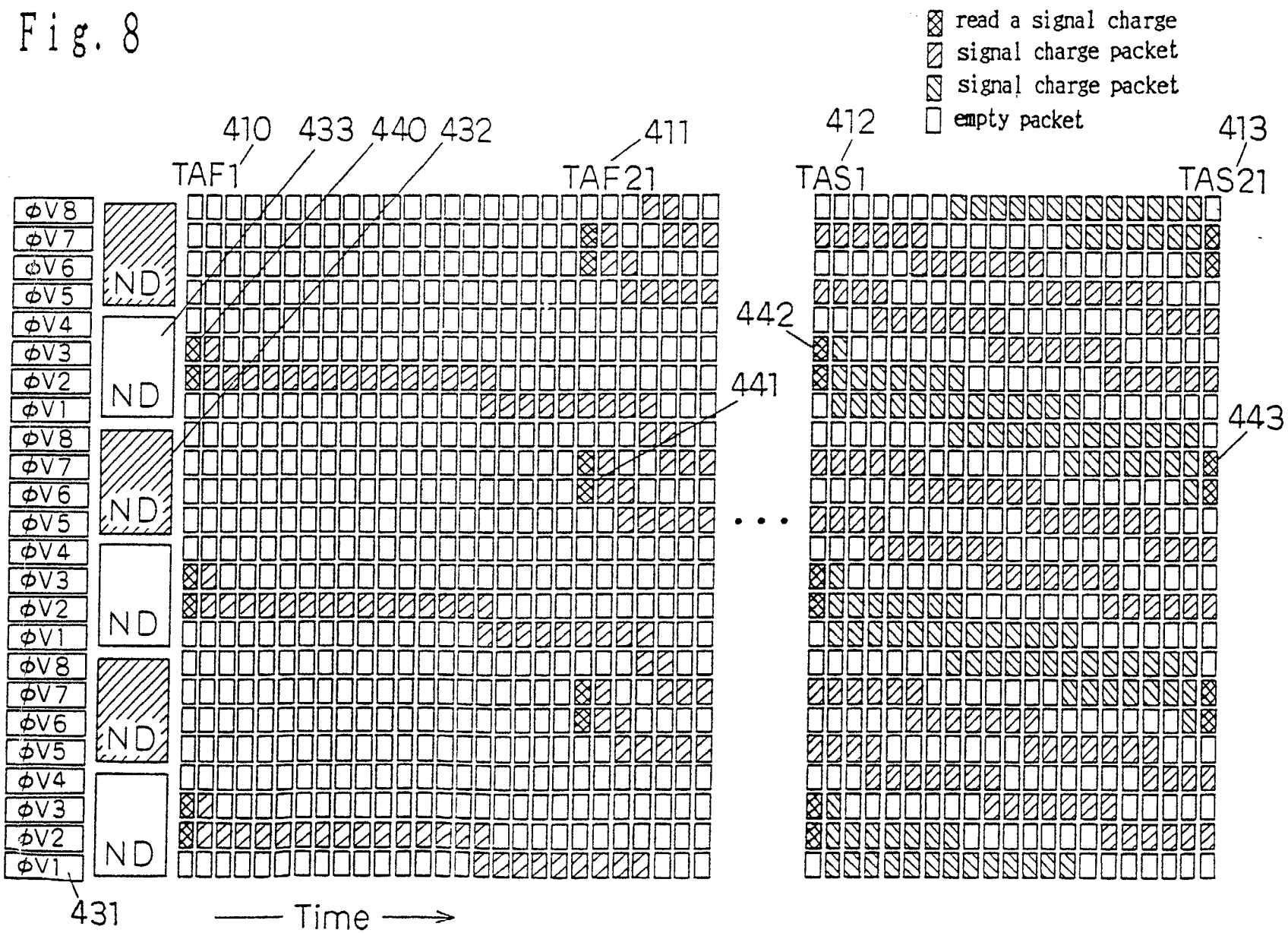

read a signal charge
signal charge packet
signal charge packet
empty packet
410
433
440
432
411
412
413
TAF1
TAF21
TAS1
TAS21
442
441
443
ND
ND
ND
ND
ND
φV8
φV7
φV6
φV5
φV4
φV3
φV2
φV1
431
Time

Fig. 9

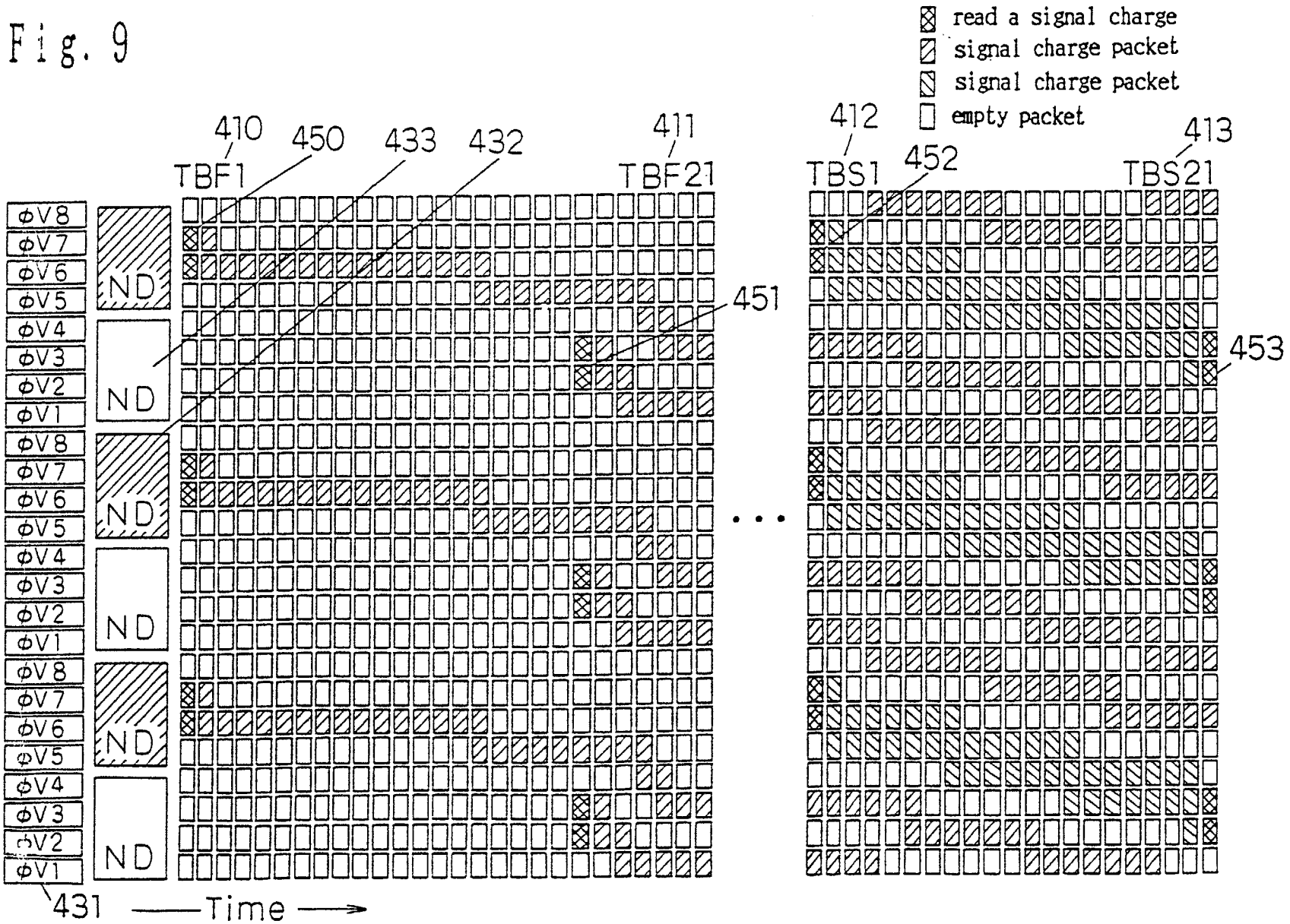
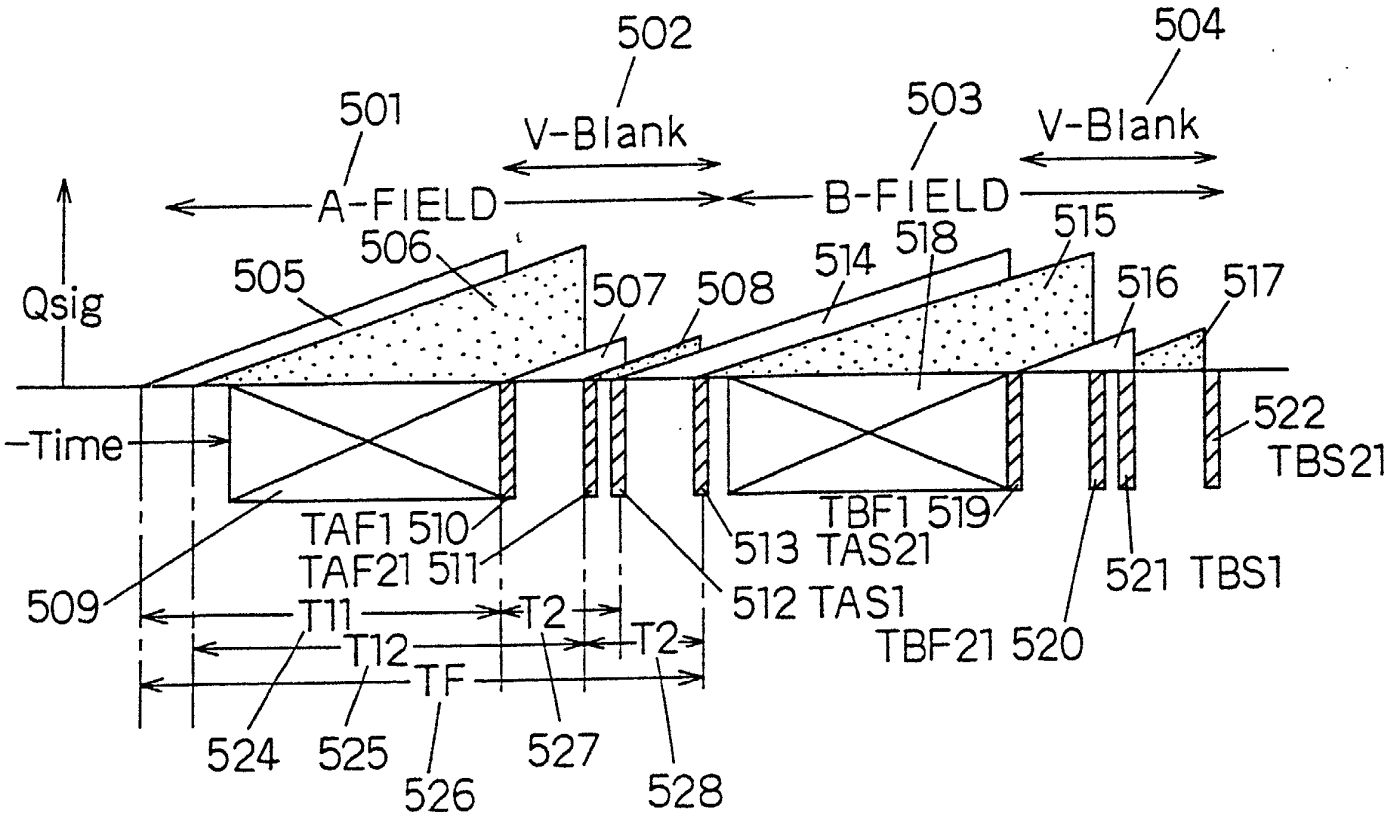

read a signal charge
signal charge packet
signal charge packet
empty packet
410
450
433
432
411
412
452
413
TBF1
TBF21
TBS1
TBS21
451
453
ND
ND
ND
ND
ΦV8
ΦV7
ΦV6
ΦV5
ΦV4
ΦV3
ΦV2
ΦV1
431
Time

Fig. 10


502
504
501
503
V-Blank
V-Blank
A-FIELD
B-FIELD
515
506
518
505
514
516
517
Qsig
507
508
522
Time
TBS21
TAF1 510
TBF1 519
513 TAS21
TAF21 511
521 TBS1
509
512 TAS1
T11
T2
T12
T2
TBF21 520
TF
524
525
527
526
528